

## CLAIMS

The invention claimed is:

1. A system for measuring a voltage differential in a current-carrying pipe using a propulsion vehicle for conveying the system inside the pipe, the system comprising:

a first contact for maintaining electrical contact with the pipe as the vehicle moves through the pipe;

a second contact positioned in a spaced apart relationship from said first contact for maintaining electrical contact with the pipe as the vehicle moves through the pipe; and

a voltage reading device connected to said first contact and said second contact for measuring the voltage between said first contact and said second contact as the vehicle moves through the pipe.

2. The method of Claim 1 wherein said propulsion vehicle is a pig.

3. The method of Claim 1 wherein said first contact comprises one more devices for maintaining electrical contact between said pipe and said first contact.

4. The method of Claim 3 wherein at least one of said devices is a brush.

5. The method of Claim 3 wherein at least one of said devices is a knife.

6. The method of Claim 3 wherein at least one of said devices is configured to reduce noise received by said voltage reading device.

7. The method of Claim 3 wherein said second contact comprises one or more devices for maintaining electrical contact between said pipe and said second contact.

8. The method of Claim 1 wherein said first contact comprises at least one of a plurality of brushes and knives.

9. The method of Claim 8 wherein said first contact comprises three brushes and three knives.

10. The method of Claim 1 wherein said first contact comprises at least one brush.

11. The method of Claim 1 wherein said first contact comprises at least one knife.

12. The method of Claim 1 wherein said voltage reading device is a voltmeter.

13. The method of Claim 1 further comprising one or more electromechanical devices connected to said first contact for reducing noise received by said voltage reading device.

14. The method of Claim 13 wherein said electromechanical device is a mercury contact.

15. The method of Claim 13 wherein said electromechanical device is a slip ring contact.

16. The method of Claim 1 further comprising means for compensating for thermocouple voltages.

17. The method of Claim 16 wherein said means comprise a determination of bulk fluid reference voltages.

18. The method of Claim 1 further comprising means for compensating for no contact events.

19. The method of Claim 18 wherein said means comprise an alternating current pilot signal.

20. The method of Claim 1 further comprising a location device for determining the position of said vehicle in the pipe.

21. The method of Claim 20 wherein said location device is an odometer.

22. A method for measuring a voltage differential in a current-carrying pipe, the method comprising:

inserting a propulsion vehicle into said pipe;

utilizing a first contact positioned on said propulsion vehicle to maintain electrical contact with the pipe as the vehicle moves through the pipe;

utilizing a second contact positioned in a spaced apart relationship from said first contact on said propulsion vehicle to maintain electrical contact with the pipe as the vehicle moves through the pipe;

determining the voltage between said first contact and said second contact as the vehicle moves through the pipe.

23. The method of Claim 22 further comprising determining the position of the vehicle in the pipe.

24. The method of Claim 23 wherein determining the position of the vehicle in the pipe utilizes an odometer.

25. The method of Claim 23 wherein the position of the vehicle in the pipe is tracked in real time.

26. The method of Claim 25 wherein said tracking utilizes a satellite and/or acoustic device.

27. The method of Claim 23 further comprising outputting voltage and position data.

28. The method of Claim 22 wherein said propulsion vehicle is a pig.

29. The method of Claim 22 wherein said first contact comprises one more devices for maintaining electrical contact between said pipe and said first contact.

30. The method of Claim 29 wherein at least one of said devices is a brush.

31. The method of Claim 29 wherein at least one of said devices is a knife.
32. The method of Claim 29 wherein at least one of said devices is configured to reduce noise in a voltage signal.
33. The method of Claim 22 wherein said first contact comprises at least one of a plurality of brushes and knives.
34. The method of Claim 22 wherein determining the voltage between said first contact and said second contact utilizes a voltmeter.
35. The method of Claim 22 further comprising utilizing one or more electromechanical devices connected to said first contact to reduce noise in a voltage signal.
36. The method of Claim 35 wherein said electromechanical device is a mercury contact.
37. The method of Claim 35 wherein said electromechanical device is a slip ring contact.
38. The method of Claim 22 further comprising compensating for thermocouple voltages.
39. The method of Claim 38 wherein said compensation comprises a determination of a bulk fluid reference voltage.

40. The method of Claim 22 further comprising compensating for no contact events.

41. The method of Claim 40 wherein said compensation comprises utilizing an alternating current pilot signal to identify said no contact events.

42. A system for measuring a voltage differential a current-carrying pipe using a propulsion vehicle for conveying the system inside the pipe, the system comprising:

a first contact for maintaining electrical contact with the pipe as the vehicle moves through the pipe, wherein said first contact comprises at least one of a plurality of brushes and knives;

a second contact positioned in a spaced apart relationship from said first contact for maintaining electrical contact with the pipe as the vehicle moves through the pipe, wherein said second contact comprises at least one of a plurality of brushes and knives; and

a voltage reading device connected to said first contact and said second contact for measuring the voltage between said first contact and said second contact as the vehicle moves through the pipe.